



Portable Welder

At left, and in closeup at left center, an engineer is repairing a damaged helicopter windshield, using an Inductron Toroid Welder produced by Inductron Corporation, Grafton, Virginia. The device is a commercial version of a unit developed by Langley Research Center. A low cost, low power, self-contained portable welding gun, it was designed for joining thermoplastic materials, which become soft when heated and harden when cooled. The welder has a broad range of applications for joining both thermoplastic and, using adhesives, non-thermoplastic materials in the aerospace, automotive, appliance and construction industries.

Langley developed the device to meet a need for a better way of repairing helicopter windshields. Conventionally, windshields are repaired either by using mechanical fasteners to clamp a patch, by fusing the patch with the windshield, or by adhesive bonding of the patch. Each method has drawbacks; mechanical fasteners require hole preparation and special hardware, fusing often deforms the acrylic or polycarbonate windshield material, and adhesive bonding requires fixturing and time for curing.

The simply-operated induction welding gun employs a wire-wound toroidal (ring-shaped) core to transmit magnetic flux to a screen, generating heat to the parts to be joined. In the helicopter application, the only preparation required to repair a windshield hole is cutting a metal screen, or "susceptor"—a circular strip one quarter inch wide—slightly larger than the hole. The metal screen is placed between the thermoplastic windshield and a thermoplastic patch somewhat larger than the screen, then the welding gun is positioned directly above the screen. When the toroid is energized, the alternating current produces inductive heating in the screen; the screen transmits the heat to the patch material, causing it to melt and flow into the screen, forming a bond.

Langley conducted extensive tests of the welder before making it available for commercial use. Laboratory tests (bottom left) of acrylic specimens fabricated by the toroid heating technique demonstrated high shear strength values. The welder's portability and low power requirement allow its use on-site in any type of climate with power supplied by a variety of portable sources.

